



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/837,007	04/18/2001	Mou-Shiung Lin	MEG 01-004	7677

28112 7590 12/19/2008  
SAILE ACKERMAN LLC  
28 DAVIS AVENUE  
POUGHKEEPSIE, NY 12603

EXAMINER
----------

ZARNEKE, DAVID A

ART UNIT	PAPER NUMBER
----------	--------------

2891

MAIL DATE	DELIVERY MODE
-----------	---------------

12/19/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.



## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election with traverse is acknowledged. The traversal is on the ground(s) that the presently claimed invention is within the scope of the previously claimed invention. This is found persuasive.

The restriction requirement is therefore withdrawn.

### ***Response to Arguments***

Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

Art Unit: 2891

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 55, 57, 58, 60-62, and 66-80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nozawa, US Patent 6,181,010.

Nozawa (figures 2 & 9) teaches a chip package; comprising:

a substrate [1000] having a first side and a second side opposite to said first side, wherein said substrate comprises multiple contact points at said second side, a solder mask [106] at said first side, an interconnect covered by said solder mask and a first metal pad [104] comprising a region uncovered by said solder mask, wherein said first metal pad is connected to said interconnect;

a chip [100] over said first side of said substrate, wherein said chip comprises a silicon substrate,

a copper (4, 48+) pillar [22] between said first pad and a second metal pad of said multiple layers of interconnecting lines, wherein said metal pillar is connected to said second metal pad through an opening in said polymer layer, and wherein said copper pillar has a thickness between 10 and 100 micrometers (4, 50-57);

a solder metal [200] between said copper pillar and said first pad, wherein said solder metal is connected to said first pad; and

a layer [124] between said copper pillar and said solder metal.

Nozawa fails to teach the chip comprises multiple layers of interconnecting lines comprising copper, multiple insulating layers comprising an oxide material, multiple metal vias in said multiple insulating layers and between said multiple layers of

Art Unit: 2891

interconnecting lines, wherein said multiple metal vias are connected to said multiple layers of interconnecting lines, and a polymer layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the multiple layers in the invention of Nozawa because these are conventionally known in the art layers used to redistribute the pads on the chip. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Nozawa fails to teach an titanium-containing layer between said second pad and said metal pillar, wherein said under bump metal layer is on said second metal pad, on said polymer layer and in said opening in said polymer layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a titanium containing layer in the invention of Nozawa because a titanium containing layer is conventionally known in the art layer used as barrier layer or a wetting/adhesion layer on a pad. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Nozawa fails to teach the layer [124] is a nickel-containing layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a nickel-containing layer in the invention of Nozawa because a nickel-containing layer is conventionally known in the art layer used as barrier layer or a wetting/adhesion layer. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Art Unit: 2891

Nozawa further fails to teach an underfill between said semiconductor device and said substrate, wherein said underfill contacts with said semiconductor device and said substrate and encloses said metal pillar and said solder metal.

It would have been obvious to one ordinary skill in the art at the time of the invention to use an underfill between said semiconductor device and said substrate because underfills are commonly known used by skilled artisans to protect and strengthen the package. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Regarding claim 70, Nozawa (figures 2 & 9) teaches a chip package; comprising:

a substrate [1000] having a first side and a second side opposite to said first side, wherein said substrate comprises multiple contact points at said second side, a solder mask [106] at said first side, an interconnect covered by said solder mask and a first metal pad [104] comprising a region uncovered by said solder mask, wherein said first metal pad is connected to said interconnect;

a chip [100] over said first side of said substrate, wherein said chip comprises a silicon substrate,

a copper (4, 48+) pillar [22] between said first pad and a second metal pad of said multiple layers of interconnecting lines, wherein said metal pillar is connected to said second metal pad through an opening in said polymer layer, and wherein said copper pillar has a thickness between 10 and 100 micrometers (4, 50-57);

a solder metal [200] between said copper pillar and said first pad, wherein said solder metal is connected to said first pad; and

Art Unit: 2891

a layer [124] between said copper pillar and said solder metal.

Nozawa fails to teach the chip comprises multiple layers of interconnecting lines comprising copper, multiple insulating layers comprising an oxide material, multiple metal vias in said multiple insulating layers and between said multiple layers of interconnecting lines, wherein said multiple metal vias are connected to said multiple layers of interconnecting lines, and a polymer layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the multiple layers in the invention of Nozawa because these are conventionally known in the art layers used to redistribute the pads on the chip. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Nozawa fails to teach an metal layer between said second pad and said metal pillar, wherein said metal layer is on said second metal pad, on said polymer layer and in said opening in said polymer layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a metal layer in the invention of Nozawa because a metal layer is conventionally known in the art layer used as barrier layer or a wetting/adhesion layer on a pad. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Nozawa further fails to teach an underfill between said semiconductor device and said substrate, wherein said underfill contacts with said semiconductor device and said substrate and encloses said metal pillar and said solder metal.

It would have been obvious to one ordinary skill in the art at the time of the invention to use an underfill between said semiconductor device and said substrate because underfills are commonly known used by skilled artisans to protect and strengthen the package. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Regarding claim 57, Nozawa teaches said substrate further comprises multiple third pads (figure 9 shows multiple pads) uncovered by said solder mask, wherein said solder mask is separate from said first metal pad and from said multiple third metal pads, and wherein said first pad and said multiple third metal pads are aligned in a direction parallel with a sidewall of said solder mask, wherein said first metal pad is connected to said interconnect through said sidewall.

With respect to claim 58, Nozawa teaches said copper pillar has a first sidewall recessed from a second sidewall of said nickel-containing layer (figure 2), but fails to teach a distance between said first sidewall and said second sidewall is greater than 0.2 micrometers.

It would have been obvious to one ordinary skill in the art at the time of the invention to optimize the distance to be greater than 0.2 micrometers through routine experimentation (MPEP 2144.05).

In re claims 60 and 72, while Nozawa, which teaches a circuit board (PCB) (8, 30+), fails to teach said substrate comprises a ball grid array substrate, it would have been obvious to one of ordinary skill in the art at the time of the invention to substitute a BGA for a PCB in the invention of Nozawa because BGAs and PCBs are known



Art Unit: 2891

equivalent substrates to which semiconductor devices are attached. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Regarding claims 61 and 73, while Nozawa fails to teach said multiple contact points comprise multiple contact balls at said second side, it would have been obvious to one of ordinary skill in the art at the time of the invention to use contact balls at said second side in the invention of Nozawa because contact balls are conventionally used in order to attach the package to the next level of integration. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

As to claims 62 and 74, though Nozawa fails to teach the first metal pad has a circular shape, the shape of the pad is an obvious matter of design choice. Design choices and changes of size are generally recognized as being within the level of ordinary skill in the art (MPEP 2144.04(I), (IVA) & (IVB)).

In re claims 66 and 75, though Nozawa fails to teach said nickel-containing layer has a thickness between 1 and 10 micrometers, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the nickel-containing layer thickness through routine experimentation (MPEP 2144.05).

Regarding claim 67, though Nozawa fails to teach said titanium-containing layer comprises titanium nitride, it would have been obvious to one of ordinary skill in the art

Art Unit: 2891

at the time of the invention to use titanium nitride in the invention of Nozawa because titanium nitride is a conventionally known in the art material used as a barrier layer. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

As to claims 68 and 76, though Nozawa fails to teach said copper pillar is electroplated, it would have been obvious to one of ordinary skill in the art at the time of the invention to electroplate the copper pillar in the invention of Nozawa because electroplating is a conventionally known in the art method used to deposit copper. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

In re claim 71, Nozawa teaches metal layer [124] between said copper pillar and said solder metal, but fails to teach the layer is a nickel-containing layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a nickel-containing layer in the invention of Nozawa because a nickel-containing layer is conventionally known in the art layer used as barrier layer or a wetting/adhesion layer. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Regarding claims 77-80, though Nozawa fails to teach said metal layer comprises titanium (claim 77), specifically titanium nitride (claim 78), or tungsten (claim 79) or tantalum (claim 80), it would have been obvious to one of ordinary skill in the art at the time of the invention to use a titanium nitride or tungsten or tantalum layer in the invention of Nozawa because a titanium nitride or tungsten or tantalum layer are

Art Unit: 2891

conventionally known in the art layers used as barrier layer or a wetting/adhesion layer.

The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Zarneke whose telephone number is (571)-272-1937. The examiner can normally be reached on M-Th 7:30 AM-6 PM.

Art Unit: 2891

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on (571)-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David A. Zarneke/  
Primary Examiner, Art Unit 2891  
12/17/08